Activity #8: Math: Quadratic Equation Model (Teacher version)(Spreadsheet)

Note to students: Teams of two or three students are required for this activity. Your work and answers are to be made in the provided answer spaces (use additional paper if needed) with the required graphs attached and labeled.

This activity is an extension of the activity in Advanced Algebra, Chapter 5, Prentice Hall ©1998.

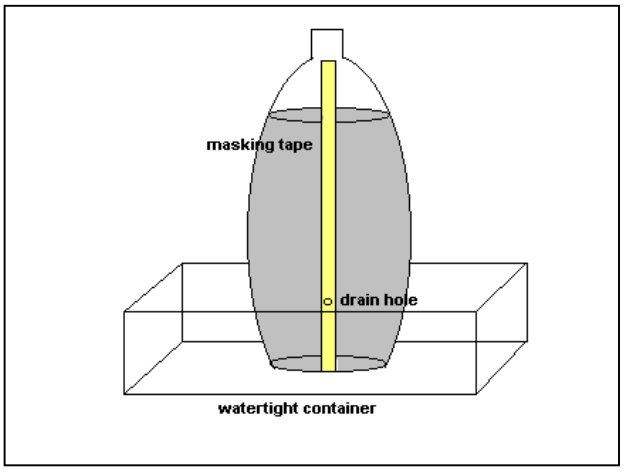
National Standards addressed:
Content Standard:
Algebra Expectations: Students will use symbolic algebra to represent and explain mathematical relationships; students will judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology; students will draw reasonable conclusions about the situation being modeled.
Process Standards:
Problem Solving Expectation: Students will build new mathematical knowledge through problem solving.
Reasoning and Proof Expectations: Students will recognize reasoning and proof as fundamental aspects of mathematics; students will make and evaluate mathematical arguments and proofs.
Communication Expectations: Students will organize and consolidate their mathematical thinking through communication; students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others; students will analyze and evaluate the mathematical thinking and strategies of others.
Connections Expectation: Students will recognize and apply mathematics in contexts outside of mathematics.

Purpose: **To understand better the quadratic equation**
To recognize a possible quadratic curve
To generate the equation from data collected using technology
To recognize phenomena that might generate these curves

Materials: computer, spreadsheet such as Excel, large plastic soda bottle, masking tape, metric ruler, stopwatch, funnel, water, large bowls

Equipment Setup:

1. Attach a piece of masking tape from the bottom to the top of the soda bottle as shown.
2. Make a small hole in the bottle through the masking tape about 5cm from the bottom of the bottle.
3. Put a piece of masking tape over this hole.
4. Place the bottle in the bowl.
5. Fill the bottle with water as shown.
6. Mark this water height on the masking tape.



Experiment Procedure:
You will be recording water height every 5 seconds (10 seconds or other suitable interval, depending on the size of the drain hole) by marking the water height on the masking tape. When ready to begin, pull the masking tape from the hole and begin the timing. After 5 seconds, one team member will signal the end of that time interval and the other member will mark the water height on the masking tape. Continue until the water height reaches zero (the level of the drain hole).
Remove the tape and measure the water height at each 5-second interval. Complete the table. Extend the table, if necessary.

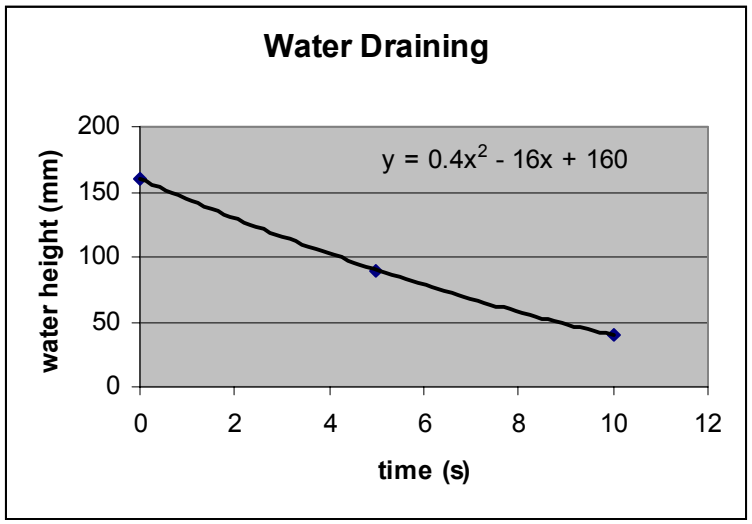
time (s)	0									
water height (mm)										

Data Analysis:
1. In your spreadsheet, enter time(s) and your values in column 1. Enter water height (mm) and your readings in column 2.
2. Select the entries in columns 1 and 2.
3. Choose Chart from the Insert menu. The, choose the XY (Scatter).
4. Give your chart the title, "Water Draining", label the x-axis as time (s) and the y-axis as water height (mm).
5. From the Chart menu, choose AddTrendline…. Pick polynomial of order 2.
6. Select the trendline, right click on Options and check the box to display the equation on the chart. Print results.
7. Write a paragraph describing this experiment and what you learned about modeling real world phenomena. What does the data and the mathematical model you found tell you about the rate at which the water flows from the bottle? Is it constant or does it change and if it changes, how?

Extension:
If you think another function might better model the data, repeat steps 4 and 5 using that regression. Printout this new model and tell why you feel it better models the data. How do these two models relate? Hint: Notice the domain values!

(Partial spreadsheet and chart follows.

time	height
0	160
5	90
10	40



Students should describe the flow of water as changing, faster at the beginning.)

The following web sites and articles may provide enrichment and support for this activity:

1. http://unr.edu/homepage/lamberth/181suxpc.pdf
2. http://www.mste.uiuc.edu/dildine/sketches/parabolas.htm
3. http://www.krellinst.org/UCES/archive/resources/conics/node52.html
4. http://mathforum.org/key/nucalc/parabola.html
5. http://library.thinkquest.org/12006/S-M-1.shtml
6. http://www.space.gc.ca/csa_sectors/space_science/microgravity_sci/means/
7. http://nasaexplores.com
8. Advanced Algebra, Chapter 5, Prentice Hall ©1998
9. http://dl.clackamas.cc.or.us/wqt121/unit-6-math.htm